SM.PROX srl
Via della Beverara 13/A - 40131 Bologna
Tel. +39 051 6350 755
www.smprox.it

Class 3B Laser Pointer Safety Manual
PRECAUTIONS FOR THE SAFETY OF OPERATORS:

ATTENTION: YOU ARE HANDLING A CLASS 3B LASER POINTER; READ THE FOLLOWING INSTRUCTIONS CAREFULLY AND APPLY ALL SAFETY MEASURES

Informations for the user and info for purchase and assistance: the manufacturer of laser products (Sm.Prox Srl) provides the user with the following operating manual containing all the information necessary for correct assembly and use of laser pointers, in compliance with the Safety Regulations indicated above.
It is the user's responsibility to implement all the precautions indicated, based on the Safety Class of the laser product and based on the type of application, to avoid damage to the eyes or skin.

CLASS 3B and CLASS 4 laser pointers in the point version are the most dangerous as, having a powerful and concentrated laser beam, they can cause damage to the retina; remember that the damage caused to the retina by laser radiation is permanent, so a damaged retina can no longer be repaired.
CLASS 3B and CLASS 4 laser pointers with optics that generate lines or crosses are generally less dangerous since the laser beam is not concentrated; however, if the pointer falls into security class 3B or CLASS 4, the same security measures indicated below must be applied.

It is necessary that before installing and using this laser pointer, the company owner carefully reads the following instructions and applies all precautions to protect the health of the operator(s) who will use this product. **"Read and apply all these precautions".**
Make sure that the operator(s) are **NEVER EXPOSED** to laser radiation exceeding the Class 1 AEL = 0,39mW. To do this it is necessary to scrupulously apply all the protections indicated below.
NEVER POINT the switched on laser pointer towards another person, an animal, towards the sky, towards another house near or far away, towards a reflective or metallic surface. As indicated in the class 3B laser safety manual, **SM.PROX LASER POINTERS ARE FOR "INDUSTRIAL" USE ONLY; THEY ARE NOT TOYS!**
APPOINTMENT OF THE LASER SAFETY TECHNICIAN (TSL): The Legislative Decree (Italy) 81/08 in art. 181 provides that the employer must make use of "qualified personnel in possession of specific knowledge on the subject "for the risk assessment and the consequent protection measures". The term "qualified personnel" correctly defines an operator who has undergone a qualification course concluded with a positive and documentable evaluation of learning. Specialized companies can provide this type of training.
Check what additional regulations there are in your country to ensure the safe use of laser pointers.
From the website https://www.laserpointersafety.com/safetyinfo/safetycalcs/index.html
it is possible to calculate some important data, necessary to use this type of pointers safely, for example:

- Formula for calculating the NOHD (from English: NOHD = Nominal Ocular Hazard Distance) = Nominal distance of the ocular risk.
- ED50 distance: 50/50 probability of causing a minimal detectable retinal lesion, under laboratory conditions.
- SZED: flashblindness = blindness distance (which can be caused by a short exposure)
- CZED: glare distance = glare distance.
- LFZED: distraction distance = distraction distance.

The site provides other useful information.

The following instructions are taken directly from:

CEI EN 60825-1 2015-12 STANDARD (English); 2017-06 (Italian)

SM.PROX srl
Via della Beverara 13/A - 40131 Bologna
Tel. +39 051 6350 755
www.smprox.it

USER'S OPERATION MANUAL:

BEFORE PUTTING THE LASER PRODUCT TO OPERATION THE USER MUST CAREFULLY READ THE FOLLOWING INSTRUCTIONS AND OBSERVE THE SAFETY REQUIREMENTS ESTABLISHED BY THOSE WHO PLACE THE LASER PRODUCT ON THE MARKET:
SM.PROX LASER POINTERS ARE FOR "INDUSTRIAL" USE ONLY; THEY ARE NOT TOYS!

Class description Class 3B

Laser products normally dangerous in the case of direct observation of the beam (i.e. within the DNRO), including accidental short-term exposures. Seeing diffuse reflections is normally safe. However, Class 3B lasers that approach the AEL for Class 3B may cause minor skin damage or pose a risk of ignition of flammable material. However, this can only happen if the beam has a small diameter or is focused.

IEC 60825-1:2014 © IEC 2014 – 39 –

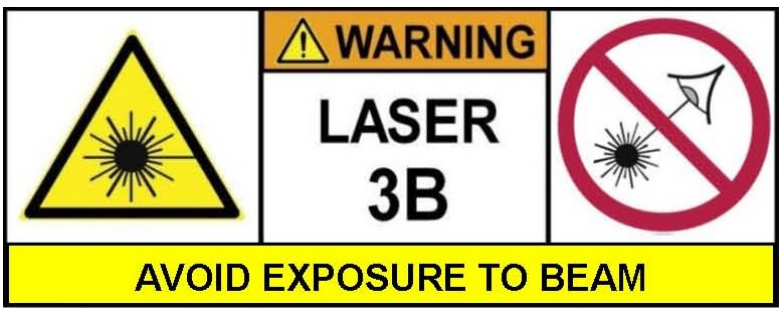
Table 8 – Accessible emission limits for Class 3B laser products [a]

Wavelength λ nm	Emission duration *t* s		
	$<10^{-9}$	10^{-9} to 0,25	0,25 to 3×10^{4}
180 to 302,5	$3{,}8 \times 10^{5}$ W	$3{,}8 \times 10^{-4}$ J	$1{,}5 \times 10^{-3}$ W
302,5 to 315	$1{,}25 \times 10^{4}\ C_2$ W	$1{,}25 \times 10^{-5}\ C_2$ J	$5 \times 10^{-5}\ C_2$ W
315 to 400	$1{,}25 \times 10^{8}$ W	0,125 J	0,5 W
400 to 700	3×10^{7} W	0,03 J for $t < 0{,}06$ s 0,5 W for $t \geq 0{,}06$ s	0,5 W
700 to 1 050	$3 \times 10^{7}\ C_4$ W	0,03 C_4 J for $t < 0{,}06\ C_4$ s 0,5 W for $t \geq 0{,}06\ C_4$ s	0,5 W
1 050 to 1 400	$1{,}5 \times 10^{8}$ W	0,15 J	0,5 W
1 400 to 10^{6}	$1{,}25 \times 10^{8}$ W	0,125 J	0,5 W

[a] For correction factors and units, see Table 9.

ATTENTION! DIRECT VIEWING OF THE BEAM IS NORMALLY DANGEROUS!

Fig. 1:



From CEI-EN 608025-1 2015:12
Read and apply all these precautions:

6.2.2 Service

Any parts of the protective housing of a laser product (including embedded laser products) that can be removed or displaced for service and which would allow access to laser radiation in excess of the AEL assigned and are not interlocked (see 6 3) shall be secured in such a way that removal or

displacement of the parts requires the use of a tool or tools

6.2.3 Removable laser system
If a laser system can be removed from its protective housing and operated by simply plugging into electrical mains or a battery, the laser system shall comply with the manufacturing requirements of Clauses 6 and 7 that are appropriate to its class

6.3 Access panels and safety interlocks
6.3.1 A safety interlock shall be provided for access panels of protective housings when both of the following conditions are met

a) the access panel is intended to be removed or displaced during maintenance or operation, and

b) the removal or displacement of the panel would give access to laser radiation levels designated by "X" in Table 13 below

The applicability of a safety interlock is indicated by (X) in Table 13 below.

Table 13 – Requirements for safety interlocking

Product class	Radiation levels that would be accessible during or after removal of access panel if there were no interlock or for overridden interlock				
	1, 1M	2, 2M	3R	3B	4
1, 1M, 1C	–	–	X	X	X
2, 2M	–	–	X	X	X
3R	–	–	–	X	X
3B	–	–	–	X	X
4	–	–	–	X	X

6.3.1 Removal or opening of an interlocked panel of the Class 1, 1C, 1M, 2 or 2M laser product shall not result in any emissions through the opening that exceed the Class 1M or Class 2M AEL, as applicable depending on the wavelength unless the interlock is deactivated after opening the panel. Removing or opening an interlocked panel of a Class 3R, 3B, or 4 laser product shall not cause any emissions through the opening to exceed the Class 3R AEL, unless the interlock is deactivated after removal. opening the panel. Higher class laser power/energy can be emitted from the open panel with the interlock deactivated.

6.3.2 If a deliberate override mechanism is provided, the manufacturer shall also provide adequate instructions about safe methods of working It shall not be possible to leave the override in operation when the access panel is returned to its normal position An exception to this requirement is allowed if selection of a service "override" mode automatically isolates the laser beam and prevents automatic resumption of operation of the machine This exception also requires a lockable mode selector and requires a manual override to use the beam.

The interlock circuit should nevertheless be arranged (through lock relay contacts or other technology) such that even in the override mode, if an open door is closed, it automatically returns to normal interlock operation (eliminating potential 'false safe' assumptions about the panel or door).
The interlock shall be clearly associated with a label conforming to 7.10.2 Use of the override shall give rise to a distinct visible or audible warning whenever the laser is energized or capacitor banks are not fully discharged, whether or not the access panel is removed or displaced Visible warnings shall be clearly visible

through protective eyewear specifically designed or specified for the wavelength(s) of the accessible laser radiation.

6.4 Remote interlock connector

Each Class 3B and Class 4 laser system shall have a remote interlock connector when the terminals of the connector are open-circuited, the accessible radiation shall not exceed the AEL for Class 1M or Class 2M as applicable This is not required for handheld, battery powered Class 3B laser systems

NOTE: Manufacturers can include a second interlock connector that does not require active action for starting
emission, but it is not required for a product to have two connectors

6.5 Manual reset

Each Class 4 laser system shall incorporate a manual reset to enable resumption of accessible Class 4 laser radiation emission after interruption of emission caused by the use of the remote interlock connector or an interruption of longer than 5 s of electrical mains power.

6.6 Key control

Each Class 3B and Class 4 laser system shall incorporate a key-operated master control The key shall be removable and the laser radiation shall not be accessible when the key is removed.

NOTE: In this Part 1, the term "key" includes any other control devices, such as magnetic cards, cipher, combinations, computer passwords, etc.

6.7 Laser radiation emission warning

6.7.1 Each Class 3R laser system in the wavelength range below 400 nm and above 700 nm and each Class 1C, Class 3B and Class 4 laser system shall satisfy the following.

6.7.2 A warning device shall give an audible or visible signal when the laser system is switched on or if any capacitor banks of a pulsed laser are being charged or have not positively discharged. The warning device shall be fail-safe or redundant. Any visible warning device shall be clearly visible through protective eyewear specifically designed for the wavelength(s) of the emitted laser radiation The visible warning device(s) shall be located so that viewing does not require exposure to laser radiation in excess of the AEL for Class 1M and 2M.

6.7.3 Each operational control and laser aperture that can be separated by 2 m or more from a radiation warning device shall itself be provided with a radiation warning device The warning device shall be clearly visible or audible to the person in the vicinity of the operational control or laser aperture.

NOTE: The emission indicator requirement can be satisfied on a hand held product where the aperture and controls are close together when it incorporates a normally off, momentarily on, switch that provides a clear, tactile indication of emission.

6.7.4 Where the laser emission may be distributed through more than one output aperture, then a visible warning device shall clearly indicate the output aperture or apertures through which laser emission can occur, in accordance with 6 7 2.

6.7.5 For a Class 3R handheld device, a momentary switch that needs to be continually depressed to allow emission may be used in lieu of the emission indicator requirement.

6.8 Beam stop or attenuator

Each Class 3B and Class 4 laser system shall incorporate one or more permanently attached means of attenuation or termination of emission (e g, beam stop, attenuator, electrical control or switch) The beam stop, switch, or attenuator shall be capable of preventing human access to laser radiation in excess of the AEL for Class 1M or Class 2M as applicable.

6.9 Controls

Each laser product shall have controls located so that adjustment and operation do not require exposure to laser radiation equivalent to Class 3R, Class 3B or Class 4

6.10 Viewing optics

Any viewing optics, viewport or display screen incorporated in a laser product shall provide sufficient attenuation to prevent human access to laser radiation in excess of the AEL for Class 1M, and, for any shutter or variable attenuator incorporated in the viewing optics, viewport or display screen, a means shall be provided to:

a) prevent human access to laser radiation in excess of the AEL for Class 1M when the shutter is opened or the attenuation varied,
b) prevent opening of the shutter or variation of the attenuator when exposure to laser radiation in excess of the AEL for Class 1M is possible

6.11 Scanning safeguard

Laser products intended to emit scanned radiation and classified on this basis, shall not, as a result of scan failure or of variation in either scan velocity or amplitude, permit human access to laser radiation in excess of the AEL for the assigned class, unless exposure of people is not reasonably foreseeable during the time interval between failure and when the scanning safeguard reduces emission to levels below the AEL of the class of the product (also see 5 1)

6.13 "Walk-in" access

If a protective housing is equipped with an access panel which provides "walk-in" access then:

a) means shall be provided so that any person inside the protective housing can prevent activation of a laser hazard that is equivalent to Class 3B or Class 4;
b) a warning device shall be situated so as to provide adequate warning of emission of laser radiation equivalent to Class 3R in the wavelength range below 400 nm and above 700 nm, or of laser radiation equivalent to Class 3B or Class 4 to any person who might be within the protective housing;
c) where "walk-in" access during operation is intended or reasonably foreseeable, emission of laser radiation that is equivalent to Class 3B or Class 4 while someone is present inside the protective housing of a Class 1, Class 2, or Class 3R product shall be prevented by engineering means.

NOTE: Methods to prevent human access to radiation when persons are inside the protective housing can include

pressure sensitive floor mats, infrared detectors, etc

6.15 Protection against other hazards
6.15.1 Non-optical hazards

the requirements of any relevant product safety standard shall be fulfilled during operation and in the event of a single fault for the following:

electrical hazards,
excessive (high or low) temperature,
spread of fire from the equipment,
sound and ultrasonics,
harmful substances,
explosion

If no provisions are included in a specific product safety standard, the relevant subclauses of IEC 61010-1 may be applied.
NOTE: Many countries have regulations for the control of harmful substances

6.15.2 Collateral radiation

The protective housing of laser products will normally protect against the hazards of collateral radiation (e g ultraviolet, visible, infrared radiation) However, if a concern exists that accessible collateral radiation might be hazardous, the laser MPE values may be applied to conservatively evaluate this hazard.

7 Labelling 7.1 General

Each laser product shall carry label(s) in accordance with the requirements of the following clauses The labels shall be durable, permanently affixed, legible, and clearly visible during operation, maintenance or service, according to their purpose They shall be so positioned that they can be read without the necessity for human exposure to laser radiation in excess of the AEL for Class 1 Text borders and symbols shall be black on a yellow background except for Class 1, where this colour combination need not be used.

The wording of labels shown in Clause 7 is recommended but not mandatory Other wording that conveys the same meaning (including warning labels per earlier editions of IEC 60825-1) may be substituted Annex C provides additional information about the laser classes, assumptions and limitations.

If the size or design of the product makes labelling impractical, the label shall be included with the user information or on the package.

Direct printing or engraving of equivalent labels on the laser product or panels is acceptable

7.6 Class 3B
Each Class 3B laser product shall have affixed a warning label (Figure 3) and an explanatory label (Figure 4) bearing the words:

WARNING — LASER RADIATION
AVOID EXPOSURE TO BEAM
CLASS 3B LASER PRODUCT

Or see fig.1 on page 3

7.10 Labels for access panels
7.10.1 Labels for panels

Each connection and each panel of a protective housing which, when removed or displaced permits human access to laser radiation in excess of the AEL for Class 1, shall have affixed labels bearing the words (for the case of an embedded Class 1M laser, the statement instead may be included in the information for the user).

a) CAUTION — CLASS 1M LASER RADIATION WHEN OPEN DO NOT VIEW DIRECTLY WITH TELESCOPES

if the accessible radiation does not exceed the AEL for Class 1M where the level of radiation is measured according to 5 3 a) and 5 4,

b) CAUTION — CLASS 2 LASER RADIATION WHEN OPEN DO NOT STARE INTO THE BEAM

if the accessible radiation does not exceed the AEL for Class 2 where the level of radiation is measured according to 5 3 c) and 5 4,

c) CAUTION — CLASS 2M LASER RADIATION WHEN OPEN DO NOT STARE INTO THE BEAM OR VIEW DIRECTLY WITH TELESCOPES

if the accessible radiation does not exceed the AEL for Class 2M where the level of radiation is measured according to 5 3 c) and 5 4,

d) CAUTION — Class 3R LASER RADIATION WHEN OPEN AVOID DIRECT EYE EXPOSURE

if the accessible radiation does not exceed the AEL for Class 3R, Labels using AVOID EXPOSURE TO THE BEAM in the second line are also acceptable

e) WARNING — CLASS 3B LASER RADIATION WHEN OPEN AVOID EXPOSURE TO THE BEAM

if the accessible radiation does not exceed the AEL for Class 3B,

f) DANGER — CLASS 4 LASER RADIATION WHEN OPEN AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
if the accessible radiation exceeds the limits for Class 3B

This information may be provided in multiple adjacent labels on the same product

7.10.2 Labels for safety interlocked panels

Appropriate labels shall be clearly associated with each safety interlock which may be readily overridden and which would then permit human access to laser radiation in excess of the AEL of Class 1 Such labels shall be visible prior to and during interlock override and be in close proximity to the opening created by the removal of the protective housing This label shall bear the words specified in items a) to f) of 7 10 1, as applicable, with the introduction of an additional line, positioned after the first line, with the following

words:

E DI NON FUNZIONAMENTO DEGLI INTERBLOCCHI

7.13 Warning for potential hazard to the skin or anterior parts of the eye

For Class 1, 1M, 2, 2M or Class 3R, if the accessible emission exceeds the AEL of Class 3B as determined with a 3,5 mm diameter aperture placed at the closest point of human access, an additional warning shall be given on a product label and in the information for the user (see 5 3 a) for Class 1 and 1M, see 5 3 c) for Class 2 and 2M, and see 5 3 d) for Class 3R).

The following warning shall be given on the product housing and in the information for the user Text borders and symbols shall be black on a yellow background, including for Class 1.

LASER ENERGY — EXPOSURE NEAR APERTURE MAY CAUSE BURNS

NOTE: The risk of skin injury is only likely for highly divergent beams for exposure close to the aperture

8.1 Information for the user

Manufacturers of laser products shall provide (or see to the provision of) user instructions or an operation manual that contains all relevant safety information It remains the responsibility of the manufacturer to provide the safety information indicated below and to decide which additional information is relevant and, therefore, shall be provided.

7) Safety glasses and additional skin protection: choose safety glasses based on the wavelength and power of the laser. Take measures to protect your skin.

OTHER USEFUL INFORMATION:

AEL: Accessible Emission Limit: maximum accessible emission level allowed for a particular class.
MPE: Maximum Permitted Exposure: level of laser radiation to which, under normal conditions, people can be exposed without suffering harmful effects.
The following table indicates the Maximum Permissible Exposure (MPE) in the wavelength range between 400nm and 700nm:

Wavelength (nm):	Duration of issue t (Sec.):		
/	from 13 x 10 (-6) to 10 sec:	from 10 to 1.000 sec:	from 1.000 to 30.000 sec:
from 400 to 500nm:	7x10 (-4) t (0,75) J	0,39mW	0,039mW
Da 500 a 700nm:	7x10 (-4) t (0,75) J	0,39mW	0,39mW

NODD: Nominal Ocular Danger Distance: distance from the emission opening beyond which the irradiance or radiant exposure of the beam remains lower than the maximum permitted exposure (EMP) for the cornea.